Available online at www.sciencedirect.com

SciVerse ScienceDirect

Procedia Engineering 32 (2012) 354 – 360

Procedia Engineering

www.elsevier.com/locate/procedia

I-SEEC2011

A Corner Reflector Antenna on Slot Antenna Driven for 2.45 GHz Wireless LAN Systems

K. Chaiyawong*, J. Phelawan, N. Pornsuwancharoen

Nano photonic research group (NPRG), Department of electrical engineering, Faculty of Industry and Technology, Rajamangala University of Technology Isan, Sakon Nakhon Campus, Sakon Nakhon, 47160, Thailand

Elsevier use only: Received 30 September 2011; Revised 10 November 2011; Accepted 25 November 2011.

Abstract

We present new design the construction of a corner reflector antenna on slot antenna driven to be used on wireless LAN systems. The gain of antenna system is more than 13 dB with narrow beam width and the radiation patterns can be broadcasting long distant. The VSWR in results are absolutely for antenna system radiation pattern from single slot antenna at 2.4 GHz.

Keywords: Corner reflector; Wireless LAN Systems; Slot Antenna; Antenna System

1. Introduction

A corner reflector antenna on slot antenna driven for 2.45 GHz wireless LAN systems have concept of slot antenna aAssembly,alot antenna arrangement for portable personal computers, broadband microstrip-fed slot radiator, study of coupled slot antennas fed by microstrip lines, -band slot antenna for 2.4/5.2 GHz WLAN operation, .4/5-GHz dual-band triangular slot antenna with compact operation and Broadband dual-frequency cross-shaped slot cpw-fed monopole antenna for WLAN operation [1-7]. The antenna system have dual-broadband rectangular-slot antenna for 2.4/5-GHz wireless communication, Dual-frequency annular-ring slot antennas fed by CPW feed and microstrip line feed, Compact PCB monopole antenna for UWB applications, planar monopole UWB antenna with 5-GHz band-notched characteristic, rectangular slot with a novel triangle ring microstrip feed for UWB applications, Wide-band circular patch antenna with 2-pin loading for wireless communications, Numerical analysis of a small ultra wideband microstrip-fed tap monopole antenna and a simple broadband printed antenna [8-15] Furthermore, the antenna system is a simple, easily design, making it more commercially viable.

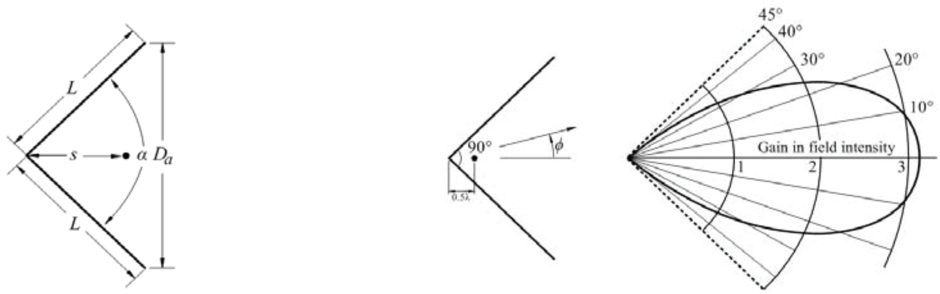
* Corresponding author. *E-mail address*: hs4pjo@hotmail.com, phelawan_1328@hotmail.com, jeewuttinun@gmail.com.

1877-7058 © 2012 Published by Elsevier Ltd. Open access under CC BY-NC-ND license.
doi:10.1016/j.proeng.2012.01.1279

In this paper, we present the theoretical background in the physical model, where design can be use to 2.4 GHz for wireless LAN system design by slot antenna and reflector antenna. In application, the high effective radiation.

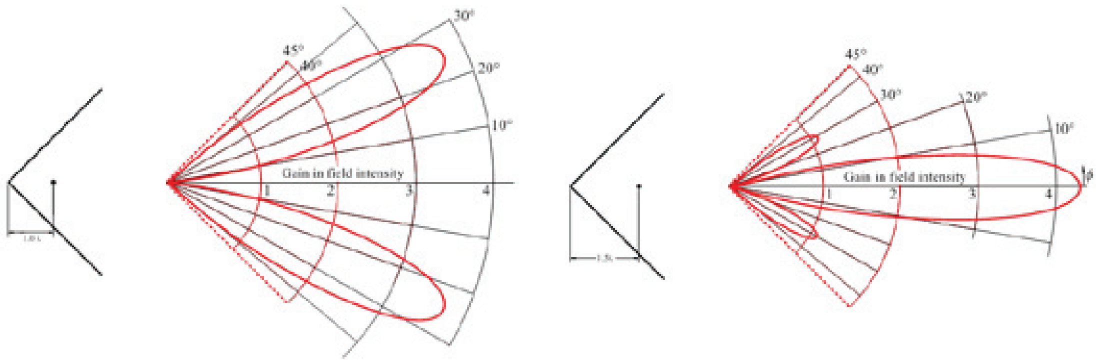
2. Theorem for Design

In this paper application for antenna design with refection pattern less than normal antennal, so that the corner reflector important to use the 90° degree of inner building show in Fig. 1(a) However, the corner have the infinite extent for the parameter L is reflector path, s is driven-to-corner, α is angle of reflector and D_a is width of pattern.



(a) (b)

Fig. 1. Show the side view for corner reflector show Fig. (a) and (b) driven-to-corner spacing is 1/2λ



(a) (b)

Fig. 2. Shown patterns of square-corner reflector antenna with driven-to-corner spacing of (a) 1λ and (b) 1.5λ. Patterns give gain relative to the 1/2λ driven (dipole antenna) in free space with the same power input

Driven or Feed element for corner reflector is usually placed 1/2λ Driven and parallel with vertex with distance "s" and if you need a wideband driven must be of good conductor with diameter growth.

Electric field analysis as a result of the spread in the angle of the flat reflector 90° Corner reflector (α=90°) show in Fig. 3 (a) and (b)

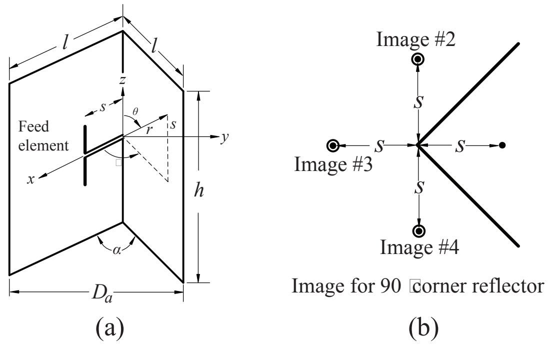


Fig. 3. (a) Structural integrity of corner reflector and (b) Image of Corner reflector

In the electric field at the point of reference is

$$E(r,\theta,\phi) = 2[\cos(ks\sin\theta\cos\phi) - \cos(ks\sin\theta\sin\phi)]f(\theta,\phi)\frac{e^{-jkr}}{r} \quad (1)$$

and

$$0 \le \phi \le \frac{\alpha}{2}$$

$$0 \le \theta \le \pi$$

$$2\pi - \frac{\alpha}{2} \le \phi \le 2\pi \quad (2)$$

and electric field of the 1/2λ driven (dipole antenna) in free space is

$$E_0 = f(\theta,\phi)\frac{e^{-jkr}}{r} \quad (3)$$

The slot antennas are popular omni-directional microwave antennas. These antennas feature omni-directional gain around the azimuth with horizontal polarization. Waveguide slot antennas, usually with an array of slots for higher gain like Fig. 4, are used at frequencies from 2 to 24 GHz

A thin slot in an infinite ground plane is the complement to a dipole in free space. This show that the slot will have the same radiation pattern as a dipole with the same dimensions as the slot, except that the E- and H-fields are swapped, as illustrated in Fig. 4, the slot is a magnetic dipole rather than an electric dipole. As a result, the polarization is rotated 90º, so that radiation from a vertical slot is polarized horizontally. For instance, a vertical slot has the same pattern as a horizontal dipole of the same dimensions — and we are able to calculate the radiation pattern of a dipole. Thus, a longitudinal slot in the broad wall of a waveguide radiates just like a dipole perpendicular to the slot.

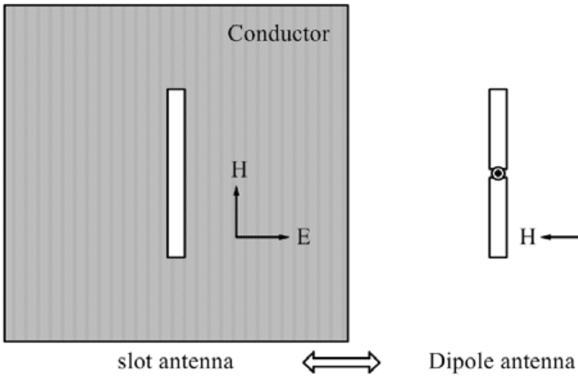
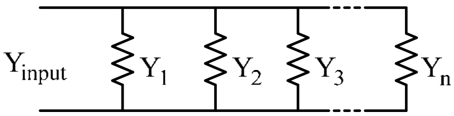


Fig. 4. Show the basic of slot antennas

A half-wavelength of transmission line has the useful property of repeating impedance: the input and output impedance are the same. As a result, the impedances, or admittances, of all the slots appear in parallel. Figure 7-6 shows this schematically. Each parallel resistor represents one slot, so there must be N resistances in parallel. The center of the last slot is a guide quarter-wavelength from the closed end of the waveguide. We know that a short-circuited quarter-wavelength stub of transmission line appears as an open-circuit, so that the closed end does not affect the impedance. Sometimes the closed end is spaced ¾ λg for mechanical reasons; the additional half wavelength is transparent.



$$Y_{input} = Y_1 + Y_2 + Y_3 + \ldots + Y_n$$

Fig. 5. Schematic of waveguide slot antenna

The slots are fed in phase by spacing their centers at electrical half-wavelength intervals along the waveguide. The electrical wavelength in waveguide is longer than in free space, so we must calculate the guide wavelength:

$$\lambda_g = \frac{1}{\sqrt{\left(\frac{1}{\lambda_0}\right)^2 - \left(\frac{1}{\lambda_c}\right)^2}} \tag{4}$$

where λ_C , the cutoff wavelength, equals 2 times the wide dimension of the waveguide. And A simple way to estimate the gain of a slot antenna is to remember that it is an array of dipoles. Each time we double the number of dipoles, we double the gain, or add 3 dB. Thus, a 16 slot array would have a gain of about 12 dBd. The approximate gain formula is thus Gain = $10log(\mathbf{N})$ dB, for **N** total slots.

Since it is really the vertical aperture of the slots rather than just the number of slots that determine the for gain and vertical beamwidth formulas:

$$Gain = 10\log\frac{N \cdot slotspacing}{\lambda_0} \text{ ......dB} \tag{5}$$

and

$$Beamwidth = 50.7\frac{\lambda_0}{\frac{N}{2} \cdot slotspacing} \text{ ......degrees} \tag{6}$$

where N is the total number of slots and *slotspacing* is normally half the guide wavelength. The beamwidth formula is the same as a uniformly illuminated aperture the length of the slot array, and is the narrowest possible beamwidth for the aperture dimension. Later, we shall see that a tapered aperture illumination can increase beamwidth and reduce sidelobe levels without significantly reducing gain.

3. Result of experiment

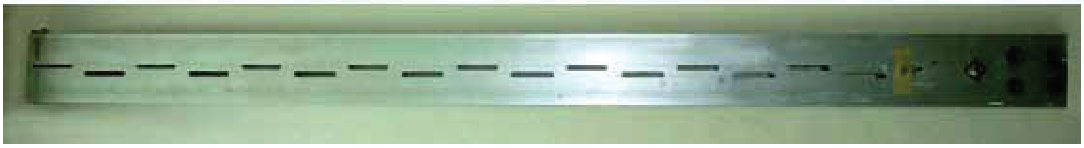


Fig. 6. (a) Front of slot antenna

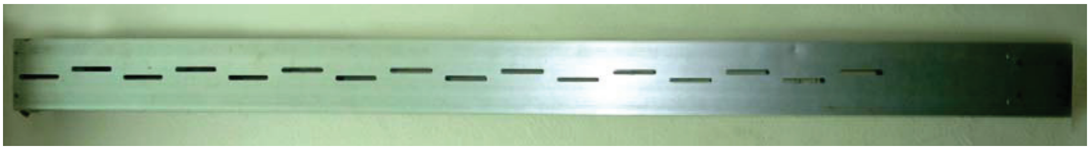


Fig. 6 (b) Back of slot antenna

Fig. 6. (c) Distance feed point and SWR tuning point in slot antenna

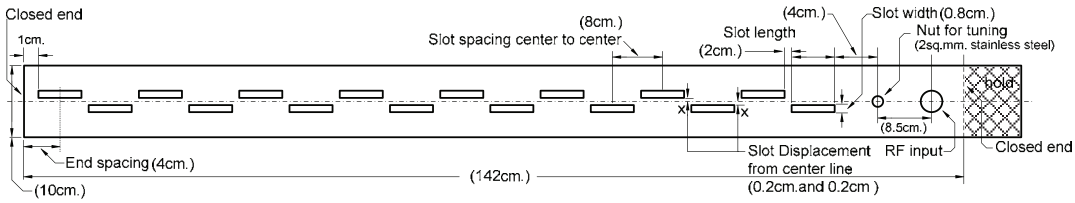
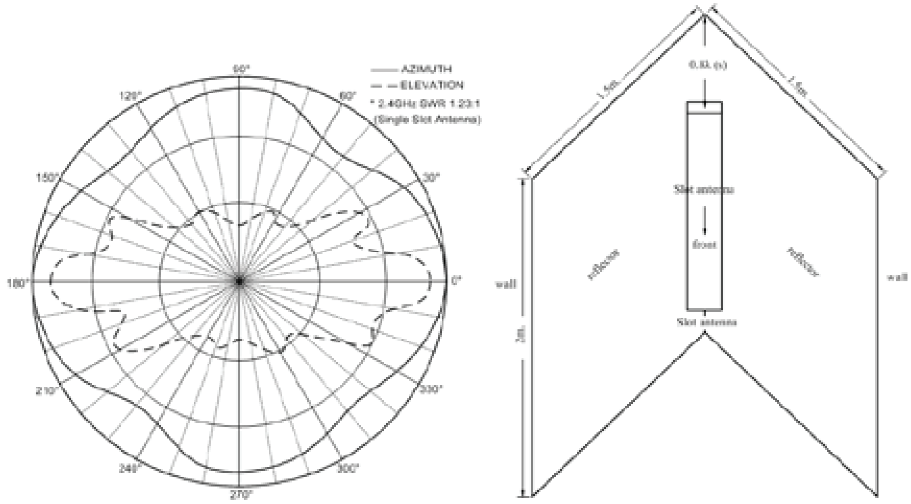


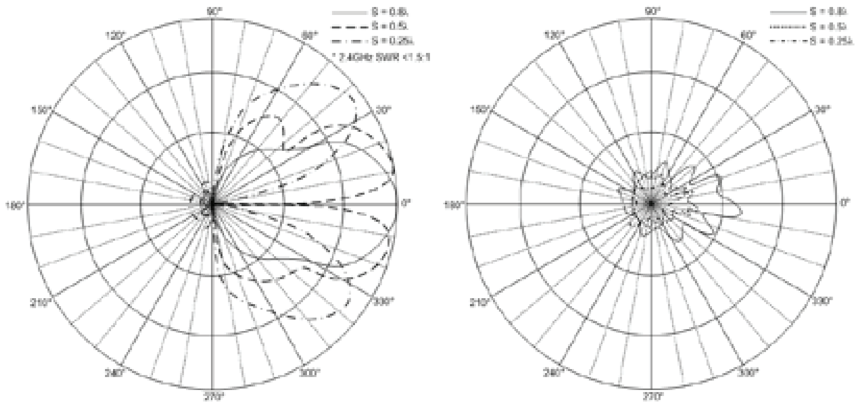
Fig. 7. shown Structure and the ratio of the slot antenna used in the experiment

Measured radiation pattern from single slot antenna at 2.4 GHz shown in Fig. 7. The pattern of slot antenna.



(a) pattern of single slot antenna (b) setup slot antenna

Fig. 8. measured radiation pattern from single slot antenna at 2.4 GHz



(a) (b)

Fig. 9. Measured radiation pattern from A Corner Reflector Antenna on Slot Antenna Driven for 2.45 GHz Wireless LAN Systems in s = 0.25, 0.5λ and 0.8λ (a) Azimuth (b) Elevation

4. Conclusions

A corner reflector antenna on slot antenna driven for 2.45 GHz wireless LAN systems created to support the wireless LAN systems and used between buildings to buildings and service area. This paper use to effectively should be installed of the slot antenna radiation corner reflector is 0.8λ to 1.0λ. The slot Antenna has biggest and we can tune SWR for slot antenna with optimization. The SWR is less than 1.5:1 for radio communication. A corner reflector antenna on slot antenna driven for 2.45 GHz Wireless LAN systems can be use for standard access point and do not increase amplifier for access point. The result can be used very good radiation distance is 1.8 km and can be very good value at a distance 300 meters.

Acknowledgement

The authors are within the Nano Photonic Research Group (NPRG), Rajamangala University of Technology Isan, Sakhon-Nakon Campus.

References

[1] Ysai, S. N., H. H. Hsin, H. K. Dai, and K. T. Cheng, *Arcuate Slot Antenna Assembly*, US Patent No. 6373443, 2002.
[2] Snowdon, R. A., *Slot Antenna Arrangement for Portable Personal Computers*, U. S. Patent No. 5677698, 1997.
[3] Axelrod, A., M. Kisliuk, and J. Maoz, "Broadband microstrip-fed slot radiator," *Microwave Journal*, 1989,**1**:81–84.
[4] Akhavan, H. G. and D. M. Syahkal, "Study of coupled slot antennas fed by microstrip lines," *The 10th International Conference on Antennas and Progagation*, 1999,1290–1292.
[5] Su, C. M., H. T. Chen, F. S. Chang, and K. L. Wong, "Dual-band slot antenna for 2.4/5.2 GHz WLAN operation," *Microwave and Optical Technology Letters*, 2002,**35**: 306–308.
[6] Wu, J. W., "2.4/5-GHz dual-band triangular slot antenna with compact operation," *Microwave andOptic al Technology Letters*, 2005,**45**:81–84.
[7] Liu, C. W., "Broadband dual-frequency cross-shaped slot cpw-fed monopole antenna for WLAN operation," *Microwave andOptic al Technology Letters*, 2005,**46**:353–355.
[8] Hsiao, H. M., J. W. Wu, and Y. D. Wang, "Novel dual-broadband rectangular-slot antenna for 2.4/5-GHz wireless communication," *Microwave andOptic al Technology Letters*, 2005,**46**:197–201.
[9] Chen, J. S., "Dual-frequency annular-ring slot antennas fed by CPW feed and microstrip line feed," *IEEE Transactions on Antennas andPr opagation*, 2005,**53**:569–571.
[10]. Ren, W., J. Y. Deng, and K. S. Chen, "Compact PCB monopole antenna for UWB applications," *Journal of Electromagnetic Waves andApplic ations*, 2007,**21**:1411–1420.
[11] Ren, W., Z. G. Shi, and K. S. Chen, "Novel planar monopole UWB antenna with 5-GHz band-notched characteristic," *Journal of Electromagnetic Waves andApplic ations*, 2007,**21**:1645–1652.
[12] Geran, F., G. Dadashzadeh, M. Fardis, N. Hojjat, and A. Ahmadi, "Rectangular slot with a novel triangle ring microstrip feed for UWB applications," *Journal of Electromagnetic Waves and Applications*, 2007,**21**:387–396.
[13] Almutairi, A. F., S. F. Mahmoud, and N. A. Aljuhaishi, "Wide-band circular patch antenna with 2-pin loading for wireless communications," *Journal of Electromagnetic Waves and Applications*, 2005,**19**: 839–851.
[14] Eldek, A. A., "Numerical analysis of a small ultra wideband microstrip-fed tap monopole antenna," *Progress In Electromagnetics Research*, PIER, 2006,**65**:59–69.
[15] Gao, S. and A. Sambell, "A simple broadband printed antenna," *Progress In Electromagnetics Research*, PIER, 2006,**60**:119– 130,